HARVARD UNIVERSITY
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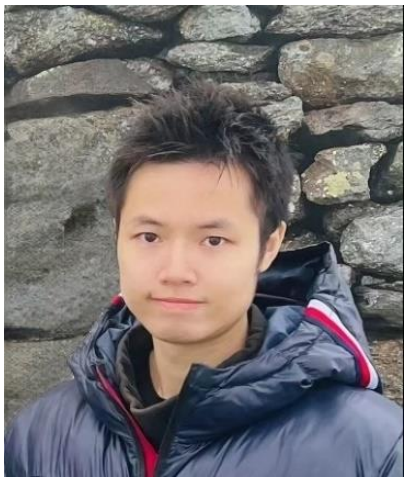
Mathematical Picture Language Seminar



Tuesday, November 12

4:30 p.m. Boston time

Jefferson 356 and Zoom

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Universal Circuit Set with S3 Quantum Double

Abstract: One potential route toward fault-tolerant universal quantum computation is to use the non-Abelian topological codes. In this work, we investigate how to perform computation with a specific non-Abelian topological order---the quantum double model D(S3). By embedding each on-site Hilbert space into a qubit-qutrit pair, we explicitly construct the circuits for creating, moving, and measuring all non-trivial anyons. These circuits incorporate a single non-Clifford gate. We also design a specific anyon interferometer to measure the total charge of well-separated anyons remotely, without fusing them together. These protocols enable the implementation of a universal gate set proposed by Cui et.al., with the possibility to correct the circuit-level noise actively during the computation process. Then, we show how to encode each physical degree of freedom of D(S3) into a novel quantum error correcting code. The encoding allows reliable realization of all gates in the anyon manipulation circuits, thereby further reducing the error rate. This suppresses the anyon error density, which facilitates the active error correction by D(S3). Our proposal offers a promising path to realize universal quantum computation in a fault-tolerant manner.

Zoom QR Code & Link:
https://harvard.zoom.us/j/779283357?pwd=MitXVm1pYUlJVzZqT3lwV2pCT1ZUQT09

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https://mathpicture.fas.harvard.edu/seminar